Republic of Iraq
Ministry of Higher Education and Scientific Research
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Collage of Science
Department of Chemistry

Practice Qualitative Chemical Analysis

First Grade - First Term

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THE PERIODIC TABLE
OF THE ELEMENTS
Lanthanide Series
Actinide Series
Alkali Metal
Alkaline Earth
Transition Metal
Basic Metal
Semimetal
Nonmetal
Halogen
Noble Gas
Lanthanide
Actinide

Experiment no (1)

Separation and Analysis of First Group

(Ag^{+1}, Hg_2^{+2} , Pb^{+2})

Group I are consists of Silver Ag^{+1}, Lead Pb^{+2}, and Mercurous Hg_2^{+2} and these ions are common of this group.

The chemical characteristics of the metals to be considered in this course shows that the chlorides of the three ions, **Ag^{+1}, Hg_2^{+2}** and Pb^{+2} are insoluble whereas those of the other cations are soluble. It is possible, therefore, to separate these three metals from the others in a general unknown by adding CI- to the solution to precipitate the chlorides of lead, silver, and mercurous.

These ions precipitated by the use of an acid solution of hydrochloric acid at a concentration (3 M) these precipitations (AgCl, $PbCl_2$, and Hg_2Cl_2) formed as shown in the equations below:

$$Ag^{+1} + HCl \rightarrow AgCl + H^{+1}$$
$$Pb^{+2} + 2HCl \rightarrow PbCl_2 + 2H^{+1}$$
$$Hg_2^{+2} + 2\,HCl \rightarrow Hg_2Cl_2 + 2H^{+1}$$

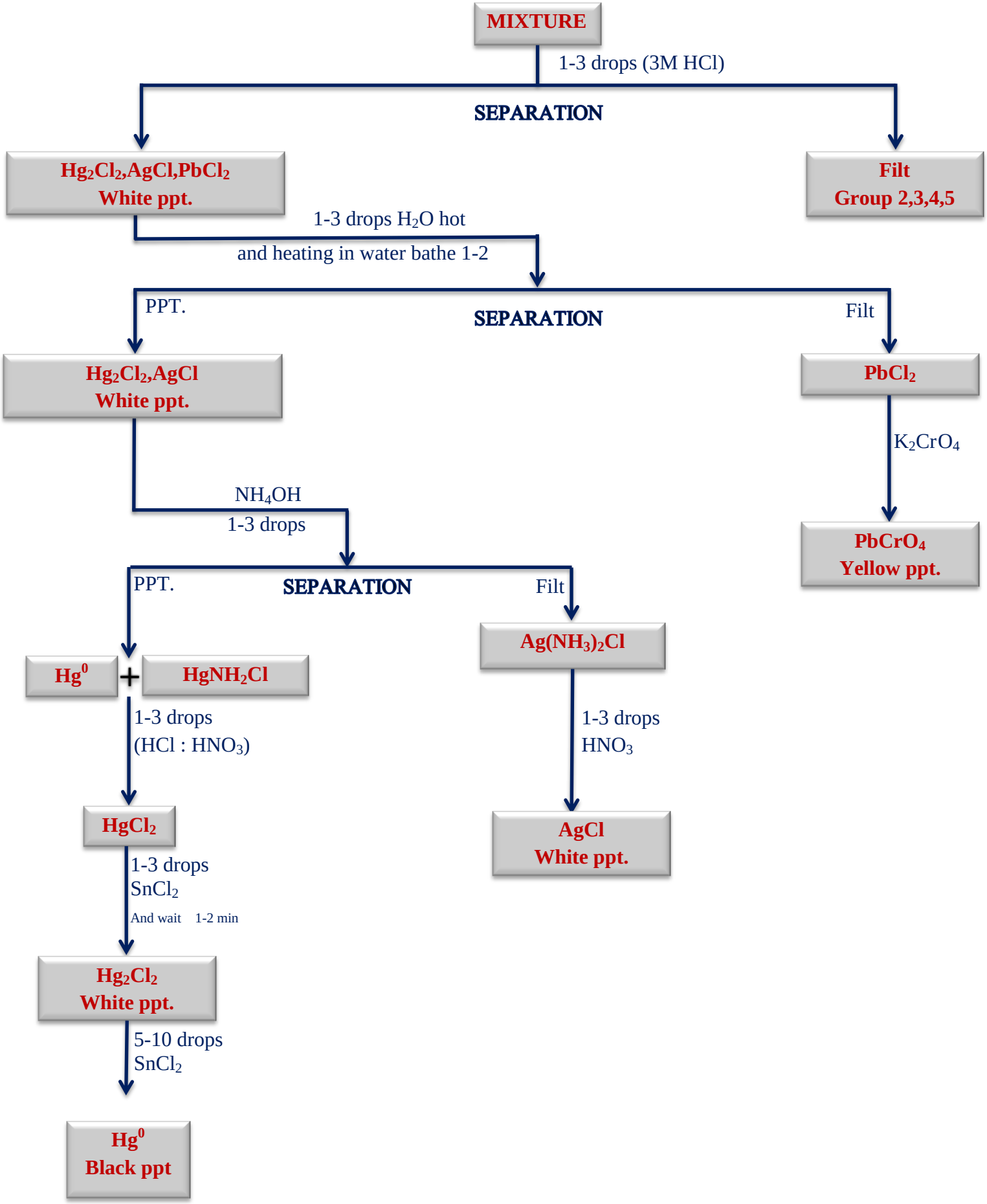
Procedure:

1- transfer 1 ml of mix. to test tube then add 3 drops of dil. HCl (3M).
2- stir the mix and put it in the centrifuge (2 min) then separate .
3- add to the filtrate 1 drop of dil. HCl .
4- the precipitate contain AgCl , $PbCl_2$, Hg_2Cl_2 which are white precipitate .
5- add 1 ml of hot dist. water then transfer to water bath (1-2 min.) .
6- transfer the test tube to centrifuge while its hot , separate the filtrated from the precipitate .

7- each ion will be identify by adding the specific reagent:

A: add $K_2Cr_2O_7$ to hot filtrated while contains Pb^{+2} , Cl^- (yellow ppt.) .
B: add (NH_4OH) to ppt.(AgCl , Hg_2Cl_2) to dissolve AgCl.
C: add dil. HNO_3 to filtrate solution to precipitate AgCl .
D: dissolve the ppt. of Hg_2Cl_2 in the (aqua regia) then add $SnCl_2$ (white ppt.) then change to gray after add excess of $SnCl_2$.

SEPARATION AND ANALYSIS OF THE FIRST GROUP I



معادلات الكشف العام لأيونات الطائفة الاولى

$$2HCl + Pb^{+2} \rightarrow PbCl_{2\,(\text{white ppt})} + 2H^{+1}$$

$$HCl + Ag^{+1} \rightarrow AgCl_{\,(\text{white ppt})} + H^{+1}$$

$$2HCl + Hg_2^{+2} \rightarrow Hg_2Cl_{2\,(\text{white ppt})} + 2H^{+1}$$

الكشف التأكيدي لأيون الرصاص

$$Pb^{+2} + K_2CrO_4 \rightarrow PbCrO_4\downarrow_{(\text{yellow ppt})} + 2K^{+1}$$

الكشف التأكيدي لأيون الفضة

$$AgCl + NH_3 \rightarrow [Ag(NH_3)_2]^+Cl^-$$

$$[Ag(NH_3)_2]^+Cl^- + HNO_3 \rightarrow AgCl\downarrow_{(\text{white ppt})} + NH_4NO_3$$

الكشف التأكيدي لأيون الزئبقوز

$$Hg^0 + 3HCl + HNO_3 \rightarrow HgCl_2 + NO + H_2O$$

$$HgNH_2Cl + 3HCl + HNO_3 \rightarrow HgCl_2 + NO + H_2O + N_2$$

$$2HgCl_2 + SnCl_2 \rightarrow Hg_2Cl_2 + SnCl_4$$

$$Hg_2Cl_2 + SnCl_2 \rightarrow 2Hg^0_{(\text{black ppt})} + SnCl_4$$